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NATIONAL SURVIVAL THROUGH SCIENCE[1]

By Dr. HARRY N. HOLMES

OBERLIN COLLEGE

When I speak of national survival through science I refer not only to the vital aid of science in winning this war, but also to its great service in the difficult years that follow. To the pessimists who believe that the Allies will lose and that the United States will finally be forced, by economic strangulation, to yield to Hitler's orders I am compelled to say that under such throttling our chief hope of survival as a free nation will lie in the resourcefulness of our scientists.

The profound influence on our civilization of anesthetics and antiseptics, the steam engine, the electric dynamo and motor, the telegraph, telephone and wireless, the cotton gin, Portland cement, the pig-iron furnace and steel mill, refrigeration and the motor car convinces every thoughtful person that this is a scientific civilization. To be truly cultured you must have some understanding of the achievements, the methods and the possibilities of scientific research.

Centuries ago recovery from great disasters such as plague, famine, flood, war and oppression was slow —fatally slow for some nations.

Medical science can now check pestilence in most of its forms, although it did not check the world epidemic of virulent flu in 1918 until millions of lives were lost. The encouraging fact to-day is that science learns from every disaster, be it yellow fever, typhus, the bubonic plague, an earthquake or a great flood on the Yellow River in China or on our own Mississippi.

Typhus fever has killed 200,000,000 people in

[1] Presidential address delivered at the one hundred and fourth meeting of the American Chemical Society, Buffalo, September 7, 1942.

Europe and Asia during recorded time and it is again threatening Europe in the war areas. The body louse that carries it is said to have done more than the Russian winter to defeat Napoleon. We are told that Hitler is in great fear of a typhus epidemic in his armies. The American and British armies have quantities of an effective serum.

Malaria, carried by a vicious type of mosquito, weakened ancient Greece and Rome and helped bring them to their fall. Very recently you read that MacArthur's army in the Bataan peninsula had so little quinine that their resistance to the Japs was tragically weakened by malaria.

When the mosquito carrying yellow fever interfered with the digging of the Panama Canal, it was too much. General Gorgas and his medical staff got rid of the mosquito.

At this moment we learn of many scattered cases of the terrible black plague in the west, a plague with a high percentage of mortality for which there is as yet no known cure. Fleas, carried by rats, squirrels and rabbits, transmit the disease. To add to our problems, we now learn that birds, picking up rabbit fur as nest material, are spreading Rocky Mountain spotted fever.

The tide of medical battles ebbs and flows, but the "men in white" always gain ground. They even make side forays against laziness, once a sin, proving that much of it is caused by infected teeth, hookworm, malaria, hay fever, a deficiency of vitamins C and B_1, and other understandable troubles. We hesitate to call this a new distinction between virtue and vice.

Famines force modern improvements in irrigation and flood control, stimulate the attack on crop diseases, force extension of transportation and may lead to planned redistribution of populations and to birth control. "Modern science," said Vice-President Wallace, "when devoted whole-heartedly to the general welfare has in it potentialities of which we do not dream."

The present disaster of a world war calls upon every resource, material, mental and spiritual, if we are to survive as a free people. To say that we were ill prepared in a military way is not enough. Our natural resources, which we viewed with complacency, had led us to prodigal extravagance. Forests disappeared and were seldom replaced. Antiquated farming methods permitted rains to wash away rich topsoil and depleted or ruined great areas by unwise cropping. The plowing of marginal grass lands of the West helped create the Dust Bowl, now being improved by contour tillage, deeper plowing and use of alternate strip cultivation.

Our most alarming extravagance, it seems, has been in the use of mineral wealth. Since 1900 world consumption of mineral resources has exceeded that of all previous ages. This acceleration can not continue indefinitely. Recovery of scrap metal must become part of a carefully planned national economy. Substitution of products derived from the soil such as wood, laminated plywood and certain plastics can help in conservation of metals.

Power will not be produced indefinitely from coal and petroleum, so we will ultimately rely upon water power, alcohol from grain and potatoes, perhaps hydrocarbons from cellulose, the world's greatest crop. Direct conversion of solar energy into heat or electricity is still in the infant experimental stage—not much more than a scientific dream.

Coal may last a thousand years, but I can well remember that twenty-five years ago prophets of doom predicted exhaustion of our petroleum reserves in fifteen or twenty years. To-day some of these authorities give us twenty years more of petroleum bliss. No matter how accurate such prophecies may be, it behooves us to conserve petroleum. Even before this war, the United States annually produced nearly 1,250,000,000 barrels, two thirds of the entire world output.

When the chemist, Burton, introduced the cracking process about 1914, doubling the yield of gasoline from every barrel of crude oil, he literally made two blades of grass grow where one grew before. Without this process—and its continuing development—you would suffer gasoline rationing in times of peace or pay a higher price while the poorer motorists did without.

All the gasoline produced in this country in 1900 would operate our motors for just one hour to-day. Much of that barrel of oil of the gay nineties was almost a drug on the market; kerosene, axle grease and paraffin wax being the most desired fractions. The refiner of fifty years ago never dreamed that heavy machines, high-speed machines, autos and airplanes would force brilliant research in lubrication. It is well known that Germany's inferior lubricants from her synthetic liquid fuels became so stiff in the Russian winter that many of her motor vehicles refused to start after once stopping. In this respect the Russians, with superior lubricants from petroleum, had a great military advantage.

Nor did the early refiners expect the navies of the world to become oil burners or that diesel engines would be invented to utilize cheap and heavy fuels for internal combustion, ultimately to drive submarines. Invention of the internal combustion engine started a revolution in petroleum refining and opened a vast market for gasoline. The demand for the greater power to be had under higher compression in the engine stimulated the chemist, Thomas Midgley, Jr., to introduce tetraethyl lead as an anti-knock agent, now accepted as a matter of course. Do not overlook

the important fact that obtaining more power from each gallon of gasoline is a valuable aid in conservation of petroleum resources.

Now comes the demand of military aviation for 100-octane fuel, as measured by Midgley's anti-knock yardstick, a demand that is being met—in the United States but not in Germany. Such high-octane gasoline is proving to be one of our most powerful offensive weapons since our enemies have little of it, must depend mainly upon 90-octane fuel for their combat planes. Our own super-product gives us 25 per cent. more power with resulting greater speed of take-off, rise and flight. Bombers with such fuel have greater range and can carry more bombs. This priceless weapon was produced in the United States at the rate of 50,000 barrels per day as of January 1, 1942. The air force unblushingly suggests 200,000 barrels to take care of the allied air armadas. The extraordinarily competent petroleum chemists and engineers sigh but expect to produce the volume needed.

Admittedly war is terrible, but it does stimulate scientific research. "It's an ill wind that blows nobody good." The necessities of World War I, especially in respect to the dyestuffs and medicines previously imported from Germany, gave this country the most powerful chemical industry in the world.

TNT or trinitrotoluene is the great bombing weapon, but its manufacture depends upon the output of toluene. Up to a year or two ago all our toluene came from coal, by way of the byproduct coke oven, perhaps 20,000,000 gallons in a year. The incredible demands for TNT, one or two billion pounds annually, depend upon five or ten times this supply of toluene. The ever-resourceful chemist came to the rescue with a process for the production of toluene in huge quantities from petroleum.

So enormous is the growing appetite of modern Mars that even leading scientists underestimated many of our needs. For example, at the beginning of 1941 this country had a capacity of 300,000 tons of fixed air nitrogen and 180,000 tons more in the form of ammonia from coke ovens. The public in general may not realize that, by the Haber process, we combine the free nitrogen of the air with hydrogen to form ammonia which is then converted into nitric acid, the basis of practically all high explosives. In spite of estimates by some scientists close to this subject that our fixed nitrogen capacity was adequate, we were forced to double this capacity within a year.

Responsible government officials failed to begin early enough, when sea lanes were open, to accumulate adequate stockpiles of strategic raw materials essential to the national defense. Not until 1940 did we begin to import for stockpiles those essential materials not produced at all or in insufficient amounts within our continental borders. The Navy was confident that Japan could not capture the East Indies and that rubber, tin and tungsten supplies were assured. Now the ferocity of German submarine attacks and the scarcity of shipping cut down to an alarming extent vital importations of other products from South America, Africa and Asia.

Priorities have been applied to such a long list of supplies that when the pinch becomes more painful the public may express its resentment in a blind and bitter reaction against our government. Yet what fraction of this public would have thought that copper, a drug on the market after the last war and produced within our own boundaries to the extent of 1,000,000 tons in 1941, would be withdrawn from public use. Or that our steel production, greater than that of all our enemies combined, would prove to be inadequate.

The unexpected enormous expansion of air forces inevitably caught us short of aluminum and magnesium in spite of a wise doubling of production within two or three years by the Aluminum Company of America. As late as 1939 our annual output of magnesium was only 6,700,000 pounds, but now requirements for 1943 are set at the astronomical figure of 725,000,000 pounds.

To the surprise of many, the 700,000 tons of chlorine produced in 1941, an all-time record, proved so inadequate that the paper manufacturers, accustomed to using it for bleaching, were confronted with chlorine rationing. Chlorine is a military substance needed for manufacture of mustard and other war gases, of anti-freeze liquids for planes, of ethyl gasoline, one plastic, neoprene rubber, grease solvents (tanks must be degreased before use), chlorinated waxes for tarpaulins, chlorinated rubber and a resin coating for a ship's magnetic belt. Fortunately production of chlorine is now approaching demand.

Did the poet Tennyson have in mind the spraying of mustard gas from airplanes when he wrote the following lines in "Locksley Hall"?

For I dipped into the future, far as human eye could see,
Saw the vision of the world, and all the wonder that would be;

Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight, dropping down their costly bales;

Heard the heavens fill with shouting, and there rained a ghastly dew
From the nations' airy navies grappling in the central blue;

Far along the world-wide whisper of the south-wind rushing warm,

With the standards of the peoples plunging thro' the thunder-storm;
Till the war-drum throbb'd no longer, and the battle-flags were furled
In the Parliament of man, the Federation of the world.

Stainless steel, containing nickel and chromium, is absolutely necessary for armor plate and for important industrial construction. I blush to admit that I was one of those confident that Canada, producing 90 per cent. of the world's nickel, could satisfy our war needs. She has the ore, but plant expansion is necessarily slow, and now we are forced to invest $20,000,000 in an effort to develop the very low-grade nickel ores of Cuba.

The chromium situation was most alarming until recently. We produced little, imported 500,000 tons of chrome ore annually from Turkey, Rhodesia, South Africa, the Philippines, Russia and Cuba. The stockpile was low and we were worried until discovery of a very large deposit of low-grade ore in Montana and working out of a successful process of concentrating the ore reassured us.

Since antimony for type metal no longer comes from China, and only limited amounts from Mexico, it is disquieting to learn that this type metal is to be used for the cores of bullets. The War Production Board is seizing the plates of the earlier editions of my own text-books. What a comforting thought to an author. After his fickle public deserts him, the product of his pen kills Japs and Germans. This gives real meaning to the old adage, "The pen is mightier than the sword."

Shortage of certain fatty oils posed a serious problem. There isn't enough linseed oil for paints and linoleum, nor tung oil from China, nor coconut oil to give extra lathering quality to soap. No more cork can come from Spain, Portugal and North Africa. We wish that great forests of cork oaks had been planted in California, a suitable place, when Leland Stanford considered the project. Plantings are about to begin, with no effect on the present emergency.

A small silk industry would be useful to-day in order to supply fabric for parachutes and powder bags for the large guns. Perhaps some special forms of nylon and cotton may meet this need, but the facts are not made public. There isn't enough formaldehyde to make plastics or plastic glues for laminated wood structures and for certain new types of explosives. And we can't import quebracho tanning extract from Argentina fast enough to tan all the leather for the army's shoes. Fortunately we know how to utilize the hemlock bark of the northwest for this purpose, although it is not yet being done. Manila hemp for rope, Indian jute for burlap bags, graphite from Madagascar and Ceylon, wool from Argentina and scores of other products give us genuine concern for they all have military value.

Let me quote a salty remark from Dr. Esselen: "Exploded completely is the complacent isolationist idea that this country has all the needed national resources. All that will save us is the national resourcefulness of our scientists." Having placed a few of our serious problems before you, it is now in order to tell something more of our efforts to solve them. The general public expects the research chemist to keep *two jumps ahead of national disaster.* This is quite in line with a recent advertisement startling the reader with the words, "Wanted. Men to Perform Miracles!"

A scientific miracle is certainly called for to save the alarming rubber situation. With only an ordinary year's supply in our stockpile, 350,000 tons of reclaimed rubber possible for this year and an equal amount for next year, very little instead of 97 per cent. of our supply coming from the East Indies and only 30,000 to 50,000 tons of imports from South America and Liberia possible for 1942, the situation is serious. The Army, Navy and Air Forces must have huge quantities of good rubber or they will lose this war.

The only hope, and it is a very promising hope, is that the chemist and the engineer will make synthetic rubber at the amazing rate of 500,000 tons or even 1,000,000 tons yearly, before it is too late. We know how to make synthetic rubbers, several of them, but time is of the essence after a tragically late start and metals for plant construction are seriously limited in quantity. Credit must be given to the du Pont Company for its production of neoprene rubber some years ago, but its higher cost limited the output to the specialty market where unusual oil resistance was desired. Expansion of neoprene plants has proceeded rapidly for the past year and 1943 production may reach 40,000 tons. It will find use in military tires. Thiokol, made for several years by the Dow Chemical Company from ethylene chloride and sodium polysulfide (therefore from petroleum, salt and sulfur) was looked upon as a rather inferior elastic material. Now it suddenly enters the war picture. Several forms of thiokol are possible and the best, Type N (using propylene chloride), has been found suitable for tire retreads. By January, 1943, the production rate will be 30,000 tons per year—enough to retread 12,000,000 tires with a life expectation of more than 5,000 miles. Better yet, this company has tested complete experimental tires of thiokol up to a life of nearly 10,000 miles at very moderate speed.

Butyl rubber, developed only recently by the Standard Oil Company of New Jersey, is another second-class substitute of great importance. Although its life in tires may be only 15,000 to 18,000 miles at

thirty-five miles per hour, such tires will take workmen to defense plants and help maintain other essential civilian transportation. It is made from isobutylene, a material that the Standard of New Jersey now secures in quantity from petroleum refining by a new process that permits simultaneous production of very high octane gasoline. A little isoprene or other dienes, 2 per cent., is required as a copolymer. The government program calls for 130,000 tons of butyl rubber in 1943.

Buna S, however, is the type of synthetic rubber selected by the government for a concentrated production drive. By this process the German chemists imitated nature, which hooked together isoprene units in long elastic chains to form natural rubber. The chemist, in fact, went nature one better and hooked together (polymerized) molecules of butadiene and styrene as copolymers to form a new elastic product of good quality for civilian tires, Buna S. The Standard Oil Company of New Jersey secured American rights to the process and probably improved it. Buna S at present needs admixture with a little natural rubber in the side walls of tires to decrease the heat of flexing. It is rumored that 80 per cent. of Germany's synthetic rubber tires collapsed during their first eastern "blitz" attack because of failure to mix natural rubber in side-wall material.

The great problem is to make enough butadiene, for the styrene is readily made from coal. The chemist has a choice of processes: to make butadiene from certain products of the petroleum refinery, from starch (grain or potato) or from acetylene. Russia selects potato starch as the basic raw material, converting it into alcohol and, by a catalytic process, converting the alcohol into butadiene. We have greatly improved the Russian process and there is powerful pressure from farm interests to make this our official method. Claims of quicker production, lower costs and use of less critical metal in construction fill the air with controversy. However, the oil companies began their work earlier, have contracts, conversion plants built or building, so the situation is not quite the same as if both methods were to start "from scratch." To complicate decisions comes announcement by our Department of Agriculture that the Northern Regional Laboratory at Peoria, Illinois, has a pilot plant producing butylene glycol from grain starch by use of a special ferment and converting this glycol into butadiene.

The government allocation of materials and money would be a simple matter if we had plenty of steel and copper. As it is, the official plans for annual production of synthetic rubber[2] are currently set at:

700,000 tons of Buna S
(of this 500,000 tons from petroleum refinery sources
and 200,000 " " grain)
130,000 tons of Butyl rubber
40,000 " " Neoprene
30,000 " " Thiokol
900,000 " total

Engineers generally estimate a year and a half or more as the time required to build and test a large Buna S plant based on petroleum fractions. By the end of 1942 our capacity may approach the 100,000 ton rate. Possibly by the end of 1943 this rate will reach 500,000 tons, yet predictions are hazardous. In any event, the driving public will get little comfort before 1944.

If airplanes are to turn the tide of victory our way, there must be no lack for plane construction of aluminum and magnesium. Fortunately for the aluminum program, President Roosevelt was farsighted years before the war in pushing on a reluctant public construction of enormous water power projects along the Tennessee and Columbia rivers. Direct war needs of aluminum this year total 1,200,000,000 pounds and the demand in 1943 will rise to 2,000,000,000 pounds, almost five times as much as we produced two years ago. If Germany should capture the Greenland cryolite deposit, the only one in the world, it might seem that our Achilles heel had been cut, for melted cryolite is the bath in which aluminum oxide is electrolyzed. Fortunately we know how to make synthetic cryolite from our own fluorspar, soda and sulfuric acid. It is also reassuring to learn of plans to rework the red mud of aluminum ore residues. It is already ground and at hand.

Up to the present time magnesium has also required great electric power, but four or five new plants are under construction to use the new Pigeon ferrosilicon process. The basic idea is to use hot silicon to steal the oxygen from magnesium oxide. Ferrosilicon, already an important commercial product used in the steel industry, is preferred because it is cheaper than silicon alone. Lime is added to remove the silicon dioxide formed. The Dow Chemical Company, pioneer in the American magnesium industry, formerly used salt brines as a source, but for more than a year it has been using the limitless waters of the ocean.

It must be discouraging to this alert company, after raising their 1939 production of 6,700,000 pounds to a 50,000,000 pound rate on January 1, 1942, to be informed from Washington that this is mere "chicken feed," that nothing less than 400,000,000 pounds will serve 1942. If that figure is met (and it will not be),

[2] The Baruch committee report calls for annual production of 1,100,000 tons of all kinds of synthetic rubber, including 845,000 tons of Buna S; 132,000 tons of Butyl rubber; 69,000 tons of Neoprene; 60,000 tons of Thiokol. It is also recommended that 30,000 tons be added to the former allotment of Buna S to the farm.

that voracious War Production Board calmly plans to double this vast total for the next year.

Substitution is a good slogan for scientists grappling with the problem of shortages. It may well be applied to mercury which we are producing at such a rate for Britain and ourselves that early exhaustion of our very limited ore deposits is threatened. We once thought that mercury fulminate was the only good detonator for shells, yet lead azide is effective and is slowly displacing the fulminate. The ordnance department refused for a time to use anything but brass for shells because of its ideal expansion and contraction with heat changes. Meanwhile Germany, with limited amounts of copper, gave up brass as shell material and adopted a suitable type of steel. After some research our ordnance requirements included steel shells.

Smokeless powder is still made by the process used in World War I, although there is a modern American process using half the time, much less money and less alcohol. The powder so made is said to be suitable only for projectiles of 75 millimeters or less in diameter. Britain has been buying very large quantities from this company, but as yet no satisfactory business arrangements have been concluded with our own ordnance department.

One of the chemist's greatest contributions to the group of substitutes is the plastic in its numerous forms. Waterproof plastic glues make possible laminated wood parts for airplanes and for many purposes where metals were previously used. This reminds me that recently I observed prodigal use of brass railings in the elevators and stairways of a very new government building in Washington. What an unfortunate example to the country at large. Handsome and useful railings of laminated wood could have been used instead of precious brass. Why not replace such railings now and use the brass for military purposes? If the President's rubber doormat could be seized for the common good it would seem possible to start a brass raid in all our cities and a bronze statue raid wherever artistic beauty is lacking. Metal door knobs do not last long in Germany. Tin is so necessary for bronze, bearing metals and for tin cans that the announcement of a new bearing metal alloy containing only one per cent. of tin instead of the standard 83.5 per cent. is very welcome.

One of the good results of this war will be a higher standard of public health. The diet of our armed forces is excellent, supplying plenty of energy, minerals and vitamins. In fact, vitamins might reasonably be seized as contraband of war. Germany is acutely aware of the value of vitamin supplements to aviators, parachute troops and other special combatants. Britain gives free vitamin capsules to her soldiers and carrot juice to her aviators to cure possible cases of night blindness. Right now she is trying to buy all the vitamin C she can get from us. Since a deficiency in this vitamin from any cause weakens the soldier and it is now known that it is lost in heavy perspiration, we may infer that fruit juices or actual synthetic vitamin C must be required for fighters in North Africa or the tropics.

A few years ago I showed that toxic lead destroys some of the vitamin C in the bodies of workmen exposed to lead hazards. It now seems certain that toluene, benzene and TNT dust have similar ill effects. Workmen in munition plants need a diet reinforced with fruit juice, tomato juice or tablets of this vitamin. In some plants this is now being tried. The known toxicity of ZnO fume when brass is melted may well show in destruction of vitamin C. Recent reports of tetryl poisoning, with such symptoms as nausea and loss of appetite suggest a trial of B_1 and C.

We seem to have enough enemies at present, yet we have not won the insect war. The insects are winning costly victories, destroying every year $2,000,000,000 worth of crops and other materials. L. O. Howard, former chief of the United States Bureau of Entomology, once said: "If human beings are to continue to exist they must first gain mastery over insects. Life may develop into a struggle between man and insects." The botanist who breeds resistant strains of plants and the chemist who prepares insect poisons serve as man's shock troops in this everlasting fight.

The weapons of World War II and the processes of essential war industry have become so scientific that it seems almost unfair to ask men trained in West Point, Annapolis and other military institutes to make vital decisions on scientific research problems. Yet that is the system. Military men decide, with advice, no doubt, what war problems are worth investigation by our official scientific bodies. This is a bottleneck because there is no place in the curriculum of our great military institutes for research training. Perhaps research appreciation could be taught in the routine courses in chemistry and physics. (To be fair it should be recorded that efforts are now being made to improve the bottleneck situation).

Our war efforts are being hampered by the drafting of chemists, even of graduate students who, in another year or two, would receive their research training. The present serious shortage of adequately trained chemists in essential industries will rapidly grow worse. They can not be replaced by women, for there are too few trained in the subject, nor can substitutes be trained in two or three years.

Does America really appreciate brain power or does it secretly distrust trained intelligence, as the British voters for so long distrusted the brilliance

of Winston Churchill? In Germany, Professor and General Karl Haushofer, with a staff of a thousand experts in many fields, has exerted powerful influence on the grand plan of total world war. What is wrong with copying the best features of such an organization? Could we listen attentively in war and in peace to the advice of one hundred of our ablest scientists, economists, sociologists, manufacturers, labor leaders, military men and others chosen, not politically, but by their peers in their own professions or callings? We have the brains in this country to solve most of present and future difficulties if we will only give them a chance to function effectively.

In conclusion, let me deny that science is to blame from all the horrors of war. Destruction of life and property was relatively as great in the days of Genghis Khan as now. Perhaps the essential difference is that in Caesar's time the average cost of killing a soldier was twenty-four cents, while to-day it has reached several thousand dollars.

Science is the friend of the poor, for research has always lowered costs and raised the standard of living. A little more than a century ago, in England, a laborer worked 15 hours a day for a week to earn two bushels of wheat. To-day he earns two bushels (at nearly the same price) in less than half a day.

The liberating influence of the much-criticized Machine Age is convincingly shown by consideration of the cotton gin. "Without this mechanical device 37,000,000 American citizens, working 300 days per year, would be kept busy removing seed from cotton if the present rate of cotton fabric production is to be maintained" (Hugh Davis). Think of it! One fourth of our population toiling to prepare raw cotton! With three more such demanding industries the books would be closed.

At the entrance to the Rochester Public Library is carved in stone a great and richly deserved tribute.

Science
The Master of
Light and Energy
Of Time, Space and Sound
Foe of the Forces
That Assail Life

Science, I may add, has vision, which the public and many of its leaders lack. Without vision the people perish.

WHO ESTABLISHED THE ELGIN BOTANIC GARDEN?

By Dr. C. STUART GAGER
BROOKLYN BOTANIC GARDEN

THERE has been published this year a biography of "Doctor Bard of Hyde Park," by John Brett Langstaff. This is a valuable and too long-delayed contribution to the history of American science.

In a review of this book in SCIENCE for September 15, 1942, it is stated (p. 299) that Samuel Bard (1742–1821) "with his pupil David Hosack (1769–1835) established the Elgin Botanical Gardens, where Rockefeller Center now stands."

In another review of the book in the *Journal* of the New York Botanical Garden it is stated that: "Mr. Langstaff gives in detail the history of Bard's gallant though unsuccessful fight to perpetuate this institution."

In a pamphlet of 56 pages, published in the spring of 1811, entitled "A statement of facts relative to the establishment and progress of the Elgin Botanic Garden and the subsequent disposal of the same to the State of New York," Dr. David Hosack gives the facts leading to the establishment of this garden by him. Considering the known integrity of the author of the pamphlet we must consider the record authoritative, and that if Hosack had merely collaborated with another person that fact would have been clearly stated by Dr. Hosack. However, in the pamphlet, he mentions Dr. Samuel Bard but once, and then only to quote two paragraphs from an address delivered on November 14, 1909, by Dr. Bard before the Medical Society of Dutchess County. In these paragraphs Dr. Bard expresses his regret at the failure the preceding year to induce the Legislature of the State of New York to purchase "Dr. Hosack's botanic garden."

". . . it has become indispensable," says Bard, "and if we suffer this garden of Dr. Hosack's to sink, as sink it must, if left in the hands of an individual, we give a decided advantage to every medical school in the United States. . . . I hope, therefore, that the institution, as well as both our medical schools, may continue to receive a decided patronage from our government. . . ." So far as the printed records show, this would appear to be Dr. Bard's sole contribution to the endeavor to have the state acquire the garden. He was an influential citizen, and of course, may have used his influence orally in this connection. Notice Bard's own statement, *"this garden of Dr. Hosack's."*

In May, 1795, Dr. Hosack succeeded Dr. Samuel L. Mitchell as professor of botany in "the medical school of Columbia College," and the following year he "was elected to the joint professorship of botany and materia medica." On page 7 of the pamphlet above

cited, Hosack writes: "I, immediately after my appointment as professor in the college, endeavoured to accomplish its [the botanic garden's] establishment. . . . I was also strengthened in my design by the advice of those of my friends to whom I made known my wishes."

In November, 1787, Dr. Hosack addressed a communication "To the President and Members of the Board of Trustees of Columbia College" asking "that the professorship of botany and materia medica [which he held] be endowed with a certain annual salary, sufficient to defray the necessary expenses of a small garden, in which the professor may cultivate, under his immediate notice, such plants as furnish the most valuable medicines, and are most necessary for medical instruction," etc.

A committee of the trustees reported favorably on this proposal, and recommended that the sum of three hundred pounds "be annually allowed for the term of five years to Doctor Hosack for the above purposes. . . ." Since available funds were inadequate for carrying out this plan, Dr. Hosack, in February, 1800, made application to the Legislature of New York State to appropriate the necessary funds. The legislative committee to whom this request was referred reported favorably, but further consideration of the matter was indefinitely "postponed" by the Legislature.

"Thus disappointed of that public aid and encouragement which such an undertaking peculiarly demanded, and the wealth of the state enabled it to bestow, I resolved," says Dr. Hosack, "to devote my own private funds, the proceeds of my professional labor, to the prosecution of this object; trusting that when the nature of the institution should become generally known, and its utility more fully ascertained, it would receive the patronage and support of the public."

Dr. Hosack then goes on to tell how he purchased the land, and "at a considerable expense" enclosed the site with a stone wall, erected a conservatory and landscaped and planted the garden. No mention here of the name of any other person having anything whatever to do with the establishment of what was soon christened the "Elgin Botanic Garden." It should never be lost sight of that the establishment of this garden was conceived and carried through to successful realization by Dr. Hosack. Quite probably he may have conferred with his professor, Dr. Bard, and may have had his professor's approval and encouragement, but so far as the historical records show, including the published statement of Dr. Hosack, there is not the slightest foundation for the statement that Dr. Bard "with his pupil David Hosack" established the Elgin Botanic Garden.

Mr. Langstaff, on page 189 of his biography of Bard, records that Hosack, as a pupil of Bard, and twenty-seven years his junior, was interested in Bard's small hospital garden, but conceived the idea of "something more extensive than the hospital garden." Langstaff states further: "To encourage this botanic enthusiasm Bard hoped for the cooperation of 'the Society instituted in the State of New York for the promotion of Agriculture,' etc. which he had helped to found, and the society responded with the suggestion 'that a botanic garden under the direction of the society, or of the college with a view to further the agricultural interest will be set on foot and supported by legislative provision.' It was this suggestion Hosack proposed to carry out. . . ."

On page viii of "Hortus Elginensis" (2nd Ed., New York, 1811) Hosack, the author, records his "acknowledgement of the obligations I am under" to more than twenty men "both abroad and at home, who have contributed to this institution" by encouragement and the giving of plants and publications. The name of Samuel Bard is not included in this list.

Now as for the "fight" to save or perpetuate the institution. When the financial burden became too great for a man of limited means and "an increasing family of children," Dr. Hosack offered "the whole establishment for sale to the state." The bill for the purchase by the state was finally lost by six votes (Nays 49, Yeas 43). In recording the details of this struggle with the Legislature, Dr. Hosack mentions as his chief supporters "Mr. Van Vechten, General German, Colonel Van Rensselaer, Major Fairlie, Mr. Skinner, Mr. Sanford, Mr. Ross, and the speaker of the house, Mr. Wilkin." No mention of Dr. Bard. A second appeal was made to the Legislature with the "very spirited and honorable" support of Dr. James Tillary, president, and the members of the medical society of the county of New York. The board of governors of New York Hospital also passed a resolution concurring with the medical society as to the "public advantages" and value of the botanic garden *"established and owned by Dr. David Hosack"* (statement of facts, p. 39).

A committee of sixty-eight prominent citizens also passed a resolution urging the Legislature to purchase the Garden. Among the signers (*ibid.*, p. 77) appears the name of William Bard, son of Dr. Samuel Bard, but not the name of Samuel Bard.

Several county medical societies also adopted similar resolutions urging the Legislature to purchase and thus perpetuate the garden, and Dr. Samuel Bard, in an address before the Dutchess County medical society, devoted two paragraphs in support of this proposal. This address, says Dr. Hosack (p. 30 of his "Statement"), "had no inconsiderable influence in

diffusing throughout the community, correct and liberal views of this subject." As stated above, so far as the published records show, this was the only part Dr. Bard had in the effort to perpetuate the Elgin Garden.

Perhaps it should be emphasized that the object of this note is not to endeavor to disparage Dr. Bard. That would be unworthy and could find no support in the record of his admirable and altogether useful life. The aim has been merely to call attention to the historic facts concerning the founding and perpetuating of the Elgin Botanic Garden, and to counteract any misconception or unwarranted inference that might arise from reading the two reviews cited.

SCIENTIFIC EVENTS

DEATHS AND MEMORIALS

Dr. John Franklin Daniel, professor of zoology and head of the department at the University of California at Berkeley, died on November 2 at the age of sixty-nine years.

Dr. Rudolph Pintner, professor of psychology at Teachers College, Columbia University, died on November 7 in his fifty-ninth year.

Dr. Albert L. Barrows, executive secretary of the National Research Council, died on November 7 at the age of fifty-nine years.

Nelson J. Darling, manager of the plants of the General Electric Company at Lynn and Everett, Mass., died on October 26. He was fifty-eight years old.

Dr. Walter Ralph Steiner, of Hartford, Conn., consulting pathologist and bacteriologist and consulting physician to the Hartford Hospital, died on November 4 in his seventy-second year.

Nature records the death of E. T. Sandars, O.B.E., author of popular handbooks of natural history, on September 19, aged sixty-five years, and of A. R. Warnes, author of works on coal-tar distillation, known for his special study of the restoration of stonework and ancient buildings, on August 25, aged sixty-four years.

A portrait of Alexander Lowy, professor of chemistry in the University of Pittsburgh from 1918 to 1941, by Norwood MacGilvary was presented to Chancellor John G. Bowman on October 30 at a memorial service. The memorial was made possible through subscriptions of alumni, students and faculty. Dr. Wilmer E. Baldwin, assistant professor of chemistry, presided, and the presentation address was made by Dr. Alexander Silverman, head of the department of chemistry.

A Nansen Club has been formed by the Norwegian-British Institute in London to commemorate and carry on the work of Dr. Nansen.

PUBLIC HEALTH IN PERU AND ARGENTINA

The government of Peru has increased the budget for expenses on public health to 14 per cent. more than that of last year, according to the Buenos Aires correspondent of the *Journal* of the American Medical Association. The following national departments were recently established: an anti-tuberculosis department with centers for the care of patients of several categories in various regions of the country; a department of epidemiology for sanitary work concerning prevention and control of epidemics as well as for the preparation of statistics, and a department for work on rural sanitation and work against malaria. Attention is being given to the plan presented by Dr. John Winant, the ex-president of the International Labor Office, who is now the ambassador of the United States to Great Britain, for waging anti-tuberculosis campaigns. Vaccination against rural yellow fever is obligatory. It is given without any charge to persons who live in certain territories, which have been specified by the General Department of Public Health as foci of the disease. The persons living in those territories who do not want to have the vaccine and who are not immune are subject to a fine. The number of centers of the National Department against Plague, the personnel for clinical and laboratory research against plague and the number of anti-plague units have increased. The work against venereal diseases is intensified especially in the region of the port of Callao. Sanitary campaigns against endemic diseases and work for sanitation of the Peruvian selva are organized. The central laboratory of the government, which is established in the selvatic region, is in charge of the technical exploitation of many valuable plants which are of great industrial importance. The protection of mothers and children is constantly improving through the coordinated work of proper organizations, mainly the so-called ambulance for infantile hygiene, the Hospital del Niño and the Instituto Nacional del Niño. The latter organization has given medical care to more than 225,000 children, lunches to more than 55,000 pregnant women, medicine, dietetic products and about 290,000 liters of milk to children, and odontologic care, vaccines against several diseases and more than 2,400,000 lunches to school children in the various provinces. Work is carried on for increasing the number of hospitals, which is insufficient. There are seventy-two hospitals with a total number of 8,636 beds in charge of the societies of public

welfare. The National Department of Industrial Hygiene, which is a branch of the Ministry of Public Health Work and Social Welfare, was recently established. The department is in charge of the prevention of industrial diseases, especially in miners. However, later on it will be in charge of the prevention of industrial diseases in workers in all industries in the country. The department is in charge also of sanitary control of houses of industrial workers and of administration of medical care to industrial workers.

In a later issue of the *Journal* the Buenos Aires correspondent describes the work of the National Institute of Nutrition. It was established in Buenos Aires in 1928 as a municipal branch of the Rawson Hospital and was made independent of the hospital in 1938 and transformed into a national center. Dr. Pedro Escudero is the director. The work of the institute includes biologic, sociologic and economic research on nutrition, education on nutrition and social care of the people. It has six departments. The medical department has a polyclinic with offices for consultation on specialties and clinics and wards for surgery, radiology and kinesiology. It also has laboratories for clinical and pharmaceutical work. Patients who can not pay for drugs may have them free of charge. The department of nutrition is in charge of the clinic of nutritional diseases, of a section for social and economic information of the department, of a center for free distribution of mother's milk, of the dispensary and of the care of gardens for children. The research center includes the departments of microbiology, microscopy, biologic and bromatologic chemistry and dietetics. The center for education on nutrition instructs the public through the press, radio, moving pictures, exhibits and lectures. The technical center includes the National School for Dietitians and a two-year course for physicians who wish to specialize in nutrition. The National School for Dietitians, founded in 1935, gives a diploma to those who complete a three-year course on nutrition and dietetics. A requisite for entering the school is to be a graduate from a national college or to have a B.S. diploma. There are also some abbreviated courses which enable the students to secure a diploma of auxiliary dietitian. There are also courses for nurses. The Ateneo de Clínica de la Nutrición and the Asociación Argentina de Dietología are two organizations under the auspices of the institute. The former is an association of physicians who specialize in nutrition, whereas the latter is constituted by physicians, dietitians and auxiliary dietitians.

Dr. Pedro Escudero recently published a book, "La Política Nacional de la Alimentación en la República Argentina," which was edited by the Instituto Nacional de la Nutrición. The last part of the book contains the report of some of the research carried on by the institute on the nutritional conditions of the population of Buenos Aires as seen from medical, social and economic angles. There are also chapters on the means actually used to improve the nutritional conditions of the people as well as for preventing and controlling nutritional diseases in the country.

THE LANCASTER BRANCH OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE Lancaster Branch of the American Association for the Advancement of Science has announced its lectures for the season 1942–43. The lecturers and their subjects are as follows:

November 12, Dr. Waldemar Kaempffert, of *The New York Times*, "Science and the War";

December 10, Dr. Leuman M. Waugh, professor of dentistry and executive officer of the Division of Orthodontics of Columbia University, "The American Eskimo—His Food and Teeth";

January 21, the Rev. J. Joseph Lynch, professor of physics at Fordham University and director of the Seismic Observatory, "Earthquakes in the War Zone";

February 18, Dr. Detlev W. Bronk, professor of biophysics and director of the Johnson Foundation of the University of Pennsylvania, now consultant to the Secretary of War as coordinator of research at the Office of Air Surgeon, "Men and Machines in War";

March 18, Dr. W. F. G. Swann, director of the Bartol Research Foundation at Swarthmore, "Science in This Confused Age."

The Lancaster Branch was started nine years ago when Dr. Otis W. Caldwell, general secretary of the association, went to Lancaster to assist in its organization. It has grown steadily until now it has a membership of twelve hundred, with an attendance of from six hundred to a thousand at each lecture. The officers are Jaques Cattell, *chairman;* C. Vogt, *vice-chairman;* Frances A. Coventry, *secretary,* and H. M. Fry, *treasurer*.

ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

THE sixty-third annual meeting of the American Society of Mechanical Engineers will be held at the Hotel Astor, New York, from November 30 through December 4, under the presidency of James W. Parker, vice-president and chief engineer of the Detroit Edison Company.

Subjects to be discussed at the convention will include manpower and its training for maximum production; the importance of intuitive, inventive and ingenious faculties in engineering; equipment, railroads, aviation, manufacturing processes and problems, power, management, training, industrial conservation, salvage, increasing adaptability of workers to job requirements and many other topics of timeliness

in war. About a hundred and twenty-five papers will be read covering the varied fields of engineering, and panel discussions and symposia will be held, with leaders in each field presiding.

The luncheon on Monday and the hours following it will be wholly devoted to the discussion of ingenuity. Igor Sikorsky, of the Vought-Sikorsky Aircraft Corporation, will present a film on the helicopter, as an accompaniment to his talk on "Creative Engineering, Invention and Intuition." This paper will be discussed by A. R. Cullimore, president of the Newark College of Engineering; Chester I. Barnard, president of the New Jersey Bell Telephone Company; Lawrence Langner, secretary of the Inventors' Council of New York, and K. K. Paluev, of the General Electric Company of Pittsfield, Mass. The evening session on Monday will include a panel discussion on "Discovering and Encouraging Originality, Initiative and Resourcefulness in Young Americans." Concurrent programs on the same evening will cover problems of management, a symposium on the cutting of metals, papers on tube expanding and on the part played by the wood industries in aviation.

The Tuesday session will include a discussion of the increased adaptability of War Department workers to job requirements. Further topics to be covered are fuels, industrial instruments, machine design, dynamics, lubrication, aviation and power. Sound motion pictures on scrap salvage and the conservation of materials will be shown.

On Wednesday there will be a session on management attitudes. Another section will discuss oil and gas power. There will be a student luncheon on that date, and also a textile luncheon, at which Fessenden S. Blanchard, president of the Textile Research Institute, New York, will speak. In the afternoon there will be a symposium on industrial training, with papers by authorities on indentured apprentice training in wartime, pre-college vocational guidance, the effectiveness of the engineering science and management war-training program, and on special company-sponsored programs for recent engineering-college graduates. Other sessions include aviation and railroad oil and gas power.

The luncheon of the Railroad Division will be held on Thursday. Speakers in the afternoon will include the Honorable Paul V. McNutt, chairman of the War Manpower Commission. Another afternoon session will be concerned with the rubber situation. E. G. Kimmich, development engineer of the Goodyear Tire and Rubber Company, will read a paper on rubber substitutes, and Gordon M. Kline, of the National Bureau of Standards, and F. L. Yerzley will speak on "Progress in Plastics and Rubber During the Past Year." A symposium on marine power will be held in the evening. Other sessions will be devoted to discussions of sheet and tube heat exchangers and critical-pressure steam boilers.

The sessions on Friday morning will be devoted to papers on sugar and on furnace heat transmission. These will be followed by a luncheon and a panel discussion of "The Manpower Problem on the Engineering Level," over which Dr. Harvey N. Davis, president of the Stevens Institute of Technology, will preside.

The annual dinner of the society will take place on Wednesday evening, when both President James W. Parker and President-elect Harold V. Coes will be among the speakers.

THE AMERICAN ORNITHOLOGISTS' UNION

The sixtieth annual meeting of the American Ornithologists' Union was held at the Academy of Natural Sciences, Philadelphia, from October 12 to 16, with a registered attendance of 192. Twenty-seven scientific papers were read—many illustrated by color slides or films. The three days of program sessions included a like number of evening entertainments, open house at the Academy of Sciences, the annual dinner and a symposium on the Cape May area. Wednesday was spent on a conducted tour of the collections of living vertebrates at the Philadelphia Zoological Park. On Friday ornithologists in attendance took a field trip to favorable localities along the New Jersey coast, centering around the Cape May Sanctuary.

Officers elected for the new year were as follows: *President,* James L. Peters, New York City; *Vice-presidents,* George Willett, Los Angeles, and Hoyes Lloyd, Ottawa; *Secretary,* Lawrence E. Hicks, Columbus; *Treasurer,* J. Fletcher Street, Philadelphia; *Editor,* John T. Zimmer, New York City; *new members of the council:* Arthur A. Allen, Ithaca; Rudolphe M. De Schauensee, Philadelphia; Robert C. Murphy, New York City; Rudyerd Boulton, Washington, D. C.

The Brewster Medal Award was made to Margaret M. Nice, of Chicago, for her publication on "Life History of the Song Sparrow." Three fellows were elected: Clarence Cottam, Chicago; Rudolphe M. De Schauensee, Philadelphia, and Harrison F. Lewis, Ottawa.

In addition to 181 new associate members, five new members were named: Earle R. Greene, Key West; Harry W. Hann, Ann Arbor; Robert C. Miller, San Francisco; Earle L. Poole, Reading; S. Dillon Ripley, Litchfield.

The 1943 meeting, if conditions permit, will be held in New York City in October.

Lawrence E. Hicks,
Secretary, American Ornithologists' Union
The Ohio State University

SCIENTIFIC NOTES AND NEWS

THE presentation of the Perkin Medal of the Society of Chemical Industry to Dr. Robert E. Wilson, president of the Pan American Petroleum and Transport Company and of the American Oil Company, will take place on January 8 at a meeting of the society at the Chemists Club, New York City.

THE Katherine Berkan Judd prize of $1,000, which is administered by the Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York City, has been awarded to Dr. Charles Brenton Huggins, professor of surgery at the University of Chicago, in recognition of "pioneer work resulting in marked amelioration and prolongation of life of many patients with prostatic cancer."

FOR "the greatest benefits done to practical medicine in the last four years," Dr. Thomas Addis, of the School of Medicine of Stanford University, has been awarded the Cullen Prize by the Royal College of Physicians in Edinburgh, in recognition of his work on Bright's disease. The prize was founded by the late Dr. R. H. Gunning, of Edinburgh and Rio de Janeiro, in 1886.

THE Honorary Medal of the Royal College of Surgeons of England was presented on September 30 to Viscount Nuffield.

A PORTRAIT of Dr. Nevin M. Fenneman was presented on October 23 to the University of Cincinnati by his former students and other friends. He served as professor of geology at the university from 1907 until his retirement in 1937, when he was made professor emeritus. Dr. Fenneman was for several years chairman of the Division of Geology and Geography of the National Research Council, and has been president of the Association of American Geographers and of the Geological Society of America.

THE seventieth birthday of Dr. Emanuel Libman, professor of clinical medicine at Columbia University, was celebrated by an anniversary dinner given in his honor on October 31. Dr. Morris Fishbein, editor of the *Journal* of the American Medical Association; Rabbi Stephen S. Wise, Colonel Leonard G. Rowntree and Dr. Joseph H. Pratt were among the speakers.

THE degree of doctor of science was conferred on Founders Day at Alfred University on Dr. Willis H. Carrier, of the Carrier Corporation, in recognition of his work as "a pioneer in the development of air conditioning." Dr. Carrier delivered the Founders Day address. He spoke on "Trends in Technical Education."

DR. WILLIAM M. COBLEIGH, professor of chemical engineering and dean of engineering at Montana State College, previously head of the department of chemistry, has been appointed acting president of the college.

DR. WALTER H. BROWN, emeritus professor of hygiene and physical education at Stanford University School of Medicine, has been appointed professor and chairman of the department of hygiene at the University of California at Berkeley. He succeeds Dr. Robert T. Legge, who recently retired.

DR. CHESTER I. BLISS has been appointed lecturer in biometry at Yale University for the current academic year, with the rank of associate professor and assignment to the departments of botany and zoology of the Graduate School.

DR. CLIFFORD T. MORGAN, instructor in psychology at Harvard University, has been appointed assistant professor of psychology at the Johns Hopkins University effective on July 1, 1943.

DR. JAMES GRAHAM HARDY, professor emeritus of mathematics at Williams College, is serving as visiting professor at Reed College during the first and second semesters of the current academic year. Dr. Frank H. Hurley, Jr., of the department of chemistry of the Rice Institute, this year will fill the vacancy at Reed College caused by the appointment of Dr. Arthur F. Scott, head of the department of chemistry, to the acting presidency of the college.

BRADLEY DEWEY, president of the Dewey and Almy Chemical Company, Cambridge, Mass., has leave of absence for the duration of the war to enable him to accept the position of deputy rubber administrator offered to him by William M. Jeffers.

THOMAS H. MILLER has become chief of the Metals Economics Division of the U. S. Bureau of Mines.

DR. MORDECAI EZEKIEL, economic adviser to the Secretary of Agriculture, has been appointed executive assistant to Charles E. Wilson, vice-chairman of the War Production Board.

PROFESSOR A. H. HAUSRATH, a member of the vocational education staff of Iowa State College, has been named assistant chief of the training section of the Office for Emergency Management. His work will involve vocational guidance and personnel. Professor K. L. Clark, since 1939 a member of the department of mechanical engineering, has joined the staff of the Naval Research Laboratory at Washington.

DR. H. N. BROCKLESBY, chief chemist of the Fisheries Research Board of Canada, has been appointed a member of the scientific staff of the special products division of the Borden Company, with headquarters

in San Francisco with the Farallone Packing Company.

Dr. O. A. Nelson, of the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture, has been appointed a member of the technical staff of Battelle Memorial Institute, Columbus.

Dr. Byron N. Cooper and Dr. William R. Brown have joined the staff of the Virginia Geological Survey. Dr. Brown is engaged in studies of the mineral resources of piedmont Virginia, especially those useful to war industries. Dr. Cooper is in charge of studies on the stratigraphy, structure and non-metallic mineral resources in the southern half of the Appalachian Valley in Virginia. Dr. Raymond S. Edmundson, for some years a staff geologist, is in charge of similar studies in the northern half of the valley.

In furtherance of the effort to conserve quinine and seek for supplies of cinchona bark from tropical America, Norman Taylor, the director of Cinchona Products Institute, of New York, will make a survey of plantations and wild sources of bark. The trip, which includes the region from southern Mexico to Bolivia, has been authorized by the Board of Commissioners for the Netherlands East Indies.

Dr. William Bradley, lecturer in tinctorial chemistry and dyestuffs in the Manchester College of Technology, has joined the scientific staff of the British Drug Houses Ltd.

Dr. Curt P. Richter, associate professor of psychobiology at the Johns Hopkins University, will deliver the second Harvey Society Lecture of the current series at the New York Academy of Medicine on November 19. He will speak on "Total Homeostasis."

The Linsly R. Williams Memorial Lecture, the first of this year's series of Laity Lectures of the New York Academy of Medicine, was given on November 12 by Dr. R. R. Williams, chemical director of the Bell Telephone Laboratories. The title of the lecture was "Nature and Man."

Dr. Alfred Blalock, professor of surgery at the Johns Hopkins University School of Medicine, will deliver the annual Lower Lecture before the Academy of Medicine, Cleveland, on November 20. He will speak on "Surgical Shock." The lecture is made possible by a fund donated by Dr. William E. Lower, Cleveland, an honorary member and a former president of the academy.

Dr. C. E. K. Mees, director of research of the Eastman Kodak Company, spoke on November 13 on "The Application of Scientific Research to Industry" before a general seminar in chemistry sponsored by the department of chemistry of Fordham University.

The American Ethnological Society will celebrate its centenary on November 14 at the American Museum of Natural History. Dr. William Duncan Strong, director of the Ethnogeographic Board, is chairman. "Culture-contact" will be the subject of a symposium in which the subjects and speakers are as follows: (1) *Oceania,* Dr. Raymond Kennedy, professor of sociology, Yale University, and Dr. Margaret Mead, Division of Anthropology and Psychology, National Research Council; (2) *South America,* Dr. Julian H. Steward, Bureau of American Ethnology, Smithsonian Institution, and Dr. Ruth Benedict, professor of anthropology, Columbia University; (3) *North America,* Dr. Clyde Kluckhohn, professor of anthropology, Harvard University, and Dr. Ralph Linton, professor of anthropology, Columbia University. Professor A. Irving Hallowell, Professor Frank Tannenbaum and Dr. John Whiting will take part in the discussions.

The annual meeting of the American Association of Petroleum Geologists will be held at Fort Worth, Texas, on April 7, 8 and 9. All meetings, including committees, research and business meetings, will be limited to these three days.

The Congress of American-Soviet Friendship held a program of panel discussions at the Hotel New Yorker on November 7 and 8. The first session on Saturday afternoon was devoted to "Science, Exploration and the War." The moderator was Earl P. Hanson, engineer and explorer. Members of the panel were: Vilhjalmur Stefansson, Arctic explorer; Dr. Aleš Hrdlička, curator, U. S. National Museum; Dr. Donald H. Menzel, professor of astrophysics, Harvard University; Dr. Mordecai Ezekiel, economic adviser, U. S. Department of Agriculture; and Dr. W. Horsley Gantt, director of the Pavlov Institute, the Johns Hopkins University. Other panels were: "Public Health and Wartime Medicine," moderator, Dr. Henry E. Sigerist, director of the Institute of the History of Medicine, the Johns Hopkins University; "The Role of Women and Child Care in Wartime," moderator, Miss Mary Gilson, consultant, Manpower Commission; "The Arts in Wartime in the Soviet Union and in the United States," moderator, Dr. Robert K. Speer, professor of education, New York University; "Civilian Defense and Morale," moderator, Arthur Upham Pope; "Production for War Needs and the Role of Trade Unions," moderator, the Honorable Stanley Isaacs; "The Soviet Peoples and Their Allies," moderator, Professor Henry Pratt Fairchild, New York University.

Announcement has been made by the Finney-Howell Research Foundation that all applications for fellowships for next year must be filed in the office

of the foundation, 1211 Cathedral Street, Baltimore, by January 1. Applications received after that date can not be considered for 1943 awards, which will be made the first of March, 1943. This foundation was provided for in the will of the late Dr. George Walker, of Baltimore, for the support of "research work into the cause or causes and the treatment of cancer." The will directed that the surplus income from the assets of the foundation together with the principal sum should be expended within a period of ten years to support a number of fellowships in cancer research, each with an annual stipend of two thousand dollars, "in such universities, laboratories and other institutions, wherever situated, as may be approved by the Board of Directors." Fellowships carrying an annual stipend of $2,000 are awarded for the period of one year, with the possibility of renewal up to three years. Special grants of limited sums may be made to support the work carried on under a fellowship.

ORIGINAL specimens of some of the crude stone tools of the "Peking man" and casts of others have been placed on display in a new exhibit devoted to China's Old Stone Age in the department of anthropology at Field Museum of Natural History, Chicago. The exhibit shows typical stone tools from six Paleolithic sites in China, and explains their presumed chronological sequences; there is also a series of photographs to show the various methods of use of the stone tools.

Nature states that on the invitation of the president and council of the Royal Astronomical Society, the British Astronomical Association is to be accommodated in future in the rooms of the former at Burlington House, London. Negotiations have been proceeding for some months and the final arrangements were completed in time for the British Astronomical Association to hold its first meeting in the new premises on September 30. A large part of the proceedings was devoted to a survey of the history of the association since it was founded in 1890, special mention being made of its founder, Edward Walter Maunder. A number of members spoke about the progress of the association during the fifty-two years of its existence and about the influence of many of its past members in shaping its policy and assisting with its remarkable development. It is worth noticing that the present international crisis has not affected its membership adversely—an indication of the interest which the amateur possesses in various astronomical branches. The new premises provide more adequate accommodation for the library and in other ways supply greater facilities for the members to whom the change has given considerable satisfaction.

DISCUSSION

CATALYSIS AS A BIOLOGICAL FACTOR

IF we apply to biology the extensive knowledge of catalysts and their influence, reinforced as it is by wide experience in the use of catalysts in large-scale organic and inorganic chemical industry, we envisage a factor capable of giving a rational explanation of many obscure and diverse biological processes.

Even before Berzelius coined the word "catalysis" over a century ago (1836), the specificity of action of catalysts had been known, appearing later in Emil Fischer's analogy that enzyme and substrate are related as lock and key. Since specificity, as well as time, is of the essence of all biological happenings, the text-book notion that catalysts merely speed up reactions which would occur spontaneously over indefinite time, has been superseded by the view that catalysts are also *directors* of chemical change, and therefore directors of those biochemical changes which underlie all morphology, physiology and function.

Much of the success attending the industrial use of catalysts is due to recognition and control of the fact that very small changes in the structure or composition of a catalyst may result in great and permanent change in the quantity and chemical nature of the chemical output. To give a concrete case, Sir Gilbert T. Morgan found that a certain concentration of carbon monoxide and hydrogen passed at certain temperature and pressure over a catalyst composed of equimolecular proportions of chromium oxide and manganese oxide gave an effluent containing $80\frac{1}{2}$ per cent. methanol. On adding 15 per cent. rubidium to the catalyst, the effluent under like operative conditions contained only 46 per cent. methanol; but large percentages of higher branching chain alcohols appeared. Where cobalt was added to the catalyst, the formation of higher straight chain alcohols was favored. Since enormous outputs of chemical substances may be determined by small amounts of catalysts prepared in laboratory secrecy and used in factory isolation, the patent literature fails fully to reflect the use of tiny amounts of "promotors," added to catalysts to make them direct the formation of wanted compounds.

While the importance and specificity of catalysts, especially enzymes, as directors of biochemical change had long been recognized,[1] the collateral importance

[1] L. T. Troland, *Monist*, January, 1914; *Cleveland Med. Jour.*, 15: 377–89, 1916; *Am. Nat.*, 15: 321–5, 1917. J.

of the consequences of changes in the biocatalysts themselves was unknown or insufficiently appreciated. Knowledge gained from the industrial use of catalysts, which demonstrated the enormous effects that may result from the addition even of traces of specific promotor substances to catalysts, led the writer to the view[2] that an analogous situation must exist with biocatalysts.

In applying this "promotor" notion to biology, the term "modification" is preferable, since here human choice does not control. We must also recognize that a limiting case of catalyst modification arises where a new active catalyst area is brought into being by union of appropriate substructures, for example, by the fixation of a prosthetic group by a carrier.

There are here epitomized three basic biological events which seem to be clarified by the concept of catalyst modification:

(1) *Differentiation and the Orderly Course of Life:* At definite stages in the development of a zygote, specific molecules or other particles, carried in the zygote cytoplasm or formed by genic or other biocatalysts, apparently modify existing catalysts so that their chemical output is changed in nature or in relative proportions. The fixation of these modifiers may follow, for example, ionic changes which must develop as a consequence of differential diffusion when the blastula mass increases in size, and must become more marked as it assumes the gastrula form. Apart from the heavy responsibilities carried by the genes, we see here a factor that may modify both genic and non-genic catalysts in a specific and orderly manner; and the tiny amounts of the original or "templet" modifier particles could readily be carried in the zygote cytoplasm.

The fact that fully differentiated cells can continue to duplicate themselves, as such, even in tissue culture, proves that a mechanism exists for the heritable continuance of modified catalysts or of catalyst areas produced de novo. This fact has been successfully demonstrated by the work of geneticists with the self-duplicating (autocatalytic) genes, and seems probable with some other biocatalysts.

(2) *Evolution:* Any heritable catalyst change may have as a consequence changes in the biont (plant or animal) which make it structurally and/or functionally different from its progenitors. This would give a physico-chemical basis for evolution, since natural selection, operating on these differences, could result in the establishment of any new species thus originated.

(3) *Cancer:* Here there seems to be a heritable change in cellular catalysts, due to modification or following the introduction of a virus (Rous), with the consequence that the cells continuously duplicate themselves and invade healthy tissue. Non-invasive growth would constitute a benign tumor. Cancers may result from radiation (known also to produce heritable chromosomal or genic changes); or from the introduction of ultrafiltrable particles or viruses, or of definite chemical substances, for example, methylcholanthrene, or 3,4-benzpyrene; or from less defined causes, such as trauma and burns (kangri cancer). Many cancer cells have been grown as such by transplantation or in tissue culture. The main difference between cancerous and other heritable catalyst changes seems, therefore, to lie in the diagnostic consequences of the catalyst change. Other diseases may be considered from this point of view; for it must be stressed that catalyst modification may in some cases be reversible and is not necessarily heritable.

A more extended consideration of these and allied questions will be given in a paper to appear in Volume V of the international series on colloid chemistry, now in preparation.[3]

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THE INFLUENCE OF SEX ON NUTRITIONAL ACHROMOTRICHIA IN MICE

A DIFFERENCE in the response between male and female mice to nutritional achromotrichia was observed with 39 male and 55 female mice of the C-57 strain kept on a diet similar to that employed by Unna and coworkers.[1] The following observations were made.

On the 30th day of the experiment 16 of the 29 or 55 per cent. of the surviving males showed various degrees of graying, while but 3 out of 50 or 6 per cent. of the living females grayed and this was not so marked. Within 75 days all but one of the males had become gray, while 13 per cent. of the surviving females only revealed slight changes.

Three additional groups each of 8 male and 7 female C-57 mice were fed the same basic diet, but each mouse of the first group also received 0.75 mg para-aminobenzoic acid daily and each of the second group 100 gamma calcium pantothenate daily and

Alexander and C. B. Bridges, in Vol. II, "Colloid Chemistry, Theoretical and Applied," N. Y., 1928. Alwin Mittasch, "Ueber katalytische Verurschachen in biologischen Geschehen" (1935); "Ueber Katalyse und Katalysatoren in Chemie und Biologie" (1936); "Katalyse und Determinisimus" (1938), all publications by Julius Springer, Berlin.

[2] J. Alexander, *Protoplasma*, 14: 296–306, 1931; "Colloid Chemistry," 4th ed. D. Van Nostrand Company, 1937; *Biodynamica*, December, 1939.

[3] To appear in 1943, Reinhold Publishing Company, N. Y.

[1] K. Unna, G. V. Richards and W. L. Sampson, *Jour. Nutrit.*, 22: 553, 1941.

each in the third group the same daily quantities of both of the above compounds. Achromotrichia occurred in these three groups as well as it did in the larger basic experiment with the same difference in the reaction of males and females.

These observations imply that the achromotrichia produced in C-57 mice by certain dietary deficiencies may depend also on hormonal factors.

The report of Forbes[2] that a pellet containing estrogenic substances implanted subcutaneously produced local pigmentation of the fur in albino rats, while testosterone diproprionate failed to do so, is of interest in connection with these results.

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CONGENITAL AND ACQUIRED ANOMALIES OF COLOR VISION

APROPOS of recent criticism in these columns of the ambiguous concept of "color blindness,"[1] subsequently endorsed and extended by Loken and Dunlap,[2] I find after careful consideration nothing in common between the assumptions and deductions of the latter and my own.[3]

Controlled experimentation over a period of months and years will be necessary before the existence of congenital as distinct from acquired types of color anomaly can be contested.[4] Such experimentation should be carried on by responsible trained workers, combining medical with psychological techniques. Adequate insight into the uses and shortcomings of the various color tests available, based on five or more years of experience with a variety of cases, is indispensable. Ability to distinguish minor from major anomalies, a knowledge of the relations of day and night vision, of the effects on the color sense of fatigue, of excessive use of nicotine, alcohol and other drugs, and of various infections are also essential.

Promotion of the use of drugs or vitamins to enable an applicant for aviation or naval service to "pass a test," where knowledge of the permanence of the "cure" is not yet available in the opinion of the writer is little better than coaching students to cheat in a qualifying examination. In the present emergency, when perfection of vision is vital in submarine, aviation and naval branches, and when one of our opponents is undoubtedly possessed of unusual visual equipment, the ill effects of such a line of action are incalculable.

There is nothing in common between the Loken-Dunlap position and my own.[5]

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SPROUTING OF SUMAC IN DRY STORAGE

SPROUTING of adventitious buds in logs or twigs of woody species freshly cut and left in contact with moist earth is said to be common in tropical regions and not rare in temperate climates. The remarkable case of a sprout on a mulberry log in England after six years of dry storage has been recorded by the late Sir A. W. Hill,[1] but in that instance the sprout appeared after the log had been used as a prop with one end in contact with moist earth. The scriptural record[2] of the sprouting of the rod of Aaron has, of course, been familiar to many generations of men, but comparable cases in North America are not so well known. A recent development of sprouts on a stored log of staghorn sumac (*Rhus typhina* L.) although a slower proceeding than that of the biblical account is so striking as to seem noteworthy:

A sumac tree 5 inches in diameter at the base and reaching over 20 feet in height growing in the writer's yard (elevation, 320 feet) in Arlington County, Va., was cut down on September 1, 1941, and the log 12 feet long stored for curing as lumber in a dry unheated shed, where it had no direct contact with moisture for the next eleven weeks. After two weeks a number of buds and small sprouts were observed, chiefly on the basal half of the log. Four weeks later all except two of the sprouts had aborted. The larger sprout, then reaching eleven inches in length, originated at a point fifteen inches from the base of the log; the other, but 3 inches long, was at a point five feet from the base. After five more weeks, *i.e.*, eleven weeks after the log had been cut, but one sprout, the lower one, remained, it having by that time reached sixteen inches in length with a maximum diameter of seven sixteenths of an inch. By this time, November 17, some of the leaves had begun to wither at the tips, but whether from dryness or from the effect of cold was not readily determinable.

It does not seem profitable here to discuss at length the means whereby the sumac stored sufficient water for the eleven weeks' growth and transpiration. But it may be pertinent to point out that the much split

[2] T. R. Forbes, *Endocrinology*, 30: 465, 1942.

[1] E. Murray, SCIENCE, 96: 2484, 133–5, August 7, 1942.

[2] K. Dunlap and R. D. Loken, SCIENCE, 96: 2489, 251–2, September 11, 1942.

[3] *Idem.*, SCIENCE, 95: 2474, 554 *ff.*, May 29, 1942.

[4] See Köllner, "Die Störungen des Farbensinnes," 1912; or other ophthalmological texts.

[5] E. Murray, *Psychol. Bull.*, 39: 165–72, March, 1942.

[1] A. W. Hill, *Ann. Bot.*, 39: 210–211, ill., 1925.

[2] Numbers, Chapter 17.

base of the log should have been conducive to its desiccation and that certain abrasions of the bark were self-varnished by a lac-like exudate. This gum might well have been a factor in preserving within the bark much of the supply of water needed for the life of the sprouts.

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CORRECTION

I am indebted to Eugene S. McCartney for calling attention to an error in my article on "The use of generic names as common nouns," Science, Vol. 96, p. 252. *"Pelomyxa carolinensis,"* line 13, should be omitted, for "carolinensis" is not a noun in the genitive case, but an adjective in the nominative case.

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SCIENTIFIC BOOKS

ASTRONOMY, MAPS AND WEATHER

Astronomy, Maps and Weather. By C. C. Wylie. x + 449 pp. Harper and Brothers.

At the request of the Army Air Corps Flying Training Command, Professor Wylie has written this book for use in college pre-flight training courses. Because of the special demands of war-time training, the general plan differs radically from that of any of the older texts. After a general introduction to positional astronomy and to some of the basic precepts of meteorology and weather forecasting, the student is acquainted with the whys and wherefores of map-making. Then follow chapters on time and on celestial navigation and the book closes with a 150-page condensation of the material usually treated in our pre-war courses in descriptive astronomy.

In judging this book, the reviewer must bear in mind that, because of war needs, the writing was done under pressure. Among the good points of the book are the fine series of fourteen star maps and the very readable and instructive chapters on meteorology. One may congratulate the author on his well-balanced summary of astrophysics and stellar astronomy in the concluding chapters. But because this book is one of the first of the texts for a college course in science especially adapted to war-time needs it becomes necessary for the reviewer to do more than pass it by with a brief notice.

Does the book provide the student who is about to enter the Army Air Corps with such training as should prove especially beneficial to him? I fear that it only succeeds part way in this respect. In such a text the main emphasis should be on the celestial sphere; on the basic principles of optics employed in the construction and design of the sort of equipment that the student will use later; on the motions and shape of the earth and the art of map-making; on the principles of weather forecasting; on the measurement of time; and on the theory and practice of celestial navigation. Professor Wylie treats of most of these subjects, but there is in addition so much extraneous material that many a student will probably feel that he is wasting his time. For example, the space devoted to telescopes (Chapter III) could have been used to greater advantage if the author had confined himself closely to such simple optical instruments as are in daily use by aviators. Or again, in the chapter on maps one would have liked to see more than two and a half pages on map projections; this chapter would have gained much if a few typical Mercator charts and maps on the Lambert Conformal Projection could have been reproduced.

To this reviewer the least satisfactory chapter is the one on "Time." The subject of time is traditionally one that vexes the newcomer to the field. Professor Wylie's treatment of the subject fails in two respects. First, because much emphasis is placed on sidereal time. The whole trend in navigational practice is away from the use of sidereal time. The Nautical Almanac and the Air Almanac alike are both so arranged that it is unnecessary to use sidereal time in standard navigational calculations. We should not burden our beginning students with sidereal time; the subject had best be omitted entirely. My second objection is that far too little emphasis is placed on numerical applications. Our students need persistent practice in doing simple arithmetical problems. In the air, as well as on the sea, speed and accuracy in calculations are both essential. A student can not acquire good computing habits overnight. For the duration of the war simple and exact methods involving practical calculations must replace our former descriptive methods of the teaching of science.

The chapter on "Celestial Navigation" suffers from defects similar to those in the chapter on "Time." There is little reason why it should not have been expanded to three or four times its present length. One might object that this could have been done only at the expense of the concluding eight chapters on descriptive astronomy. All to the good, I would say. It is clearly the main function of a course in war-time astronomy to serve future aviators, naval officers and

many others who depend on celestial navigation. The time of these men is precious, and astronomers should not burden their minds with facts about stars and the universe. For future navigators the study of astronomy is now an extra-curricular activity.

Professor Wylie has taken a first important step in the development of a text on war-time astronomy. One can only hope that he will not consider the job finished with the first edition of the text. The second edition could stand drastic revision in the direction of better serving the immediate and important needs of the Army Air Corps.

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SPECIAL ARTICLES

ISOLATION OF ADRENOCORTICOTROPIC HORMONE FROM SHEEP PITUITARIES

A METHOD is herein described for the isolation of a protein from the anterior hypophysis which selectively stimulates the adrenal cortex and is free from other biologically active contaminants. Sheep pituitaries were ground and extracted with acidified 80 per cent. acetone. The extract[1] was precipitated in 90 per cent. acetone and dried. The dried powder was extracted with 0.1 M Na_2HPO_4 and the extract again precipitated by bringing it to half saturation with $(NH_4)_2SO_4$. The precipitate was then dissolved in water and dialyzed until salt-free. The dialyzed solution was adjusted to pH 3.0 and saturated NaCl was added to 0.54 M. The precipitate formed was saved for the isolation of lactogenic hormone and the supernatant was brought to half saturation with $(NH_4)_2SO_4$. The $(NH_4)_2SO_4$ precipitate was dissolved in water and half of its volume of concentrated NH_4OH was added and the solution allowed to stand at room temperature for 4 hours. The solution was then brought to 90 per cent. acetone. The precipitate formed was suspended in water and dialyzed, first against distilled water, then against pH 7.5 phosphate buffer of ionic strength 0.10. A slight precipitate that formed was discarded. Saturated aqueous $(NH_4)_2SO_4$ was then added to the dialyzed solution to 0.4 saturation. The precipitation with $(NH_4)_2SO_4$ was repeated two more times. The final precipitate was dialyzed and adjusted to pH 3.0 and saturated NaCl solution was added to 0.54 M. The precipitate was removed and discarded and the supernatant brought to 1.35 M. The precipitation with NaCl was repeated four times.

The final precipitate obtained by NaCl at pH 3.0 was examined by electrophoretic and solubility studies. Electrophoresis experiments were carried out in a Tiselius apparatus with the Longsworth scanning method. A 1 per cent. solution of protein was used at pH 6.87, 5.84, 4.60, 4.10. The potential gradient was about 6 volts per cm; the time of electrolysis was not less than 200 minutes. All these experiments indicated that the preparation contained only one component. From these experiments the isoelectric point was estimated to be approximately pH 4.7.

In the solubility studies, the solvent employed was 1.35 M NaCl, pH 3.0. The experiments were conducted in the cold room at 2 to 3° C. When five times the amount of the solid necessary for saturation was added the solubility remained the same. The experiment indicates that protein consists of a single component.

The hormone is exceptionally stable to heat. No biological activity was lost when a 1 per cent. solution in pH 7.5 phosphate buffer of ionic strength 0.10 was placed in a water bath at 100° C. for 2 hours.

The tryptophane content was very low, approximately 0.2 per cent. It will be remembered that the tryptophane content of lactogenic hormone was found to be 2.5 per cent. when the same method of determination (glyoxalic acid) was used.

Two methods of biological standardization of adrenocorticotropic hormone were used: (I) repair of the adrenal cortex of the immature female rat, 26 to 28 days of age at hypophysectomy, 14 days post-operative, when injected once daily for 4 days, autopsy on the 5th day, increase in width of the cortex and redistribution of the lipids being the criteria; (II) maintenance of the adrenal cortex (width and lipid distribution) in the male rat 40 days old at hypophysectomy, injected once daily for 15 days (13 injections). The dose of the homogeneous protein necessary to cause detectable repair of the adrenal cortex (Method I), was 0.05 mg total dose; the minimum daily dose for maintenance (Method II) was 0.05 mg. The hormone not only stimulates the adrenal cortex as judged by morphological but also by functional criteria. It increases the resistance of hypophysectomized and normal rats to cold, starvation and anoxia.

The chemical, physical and biological properties of the adrenocorticotropic hormone will be described in more detail elsewhere.

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[1] All subsequent procedures unless otherwise specified were performed at 2 to 3° C.

NEW PENETRATING VEHICLES AND SOLVENTS[1]

THIS is a preliminary report on the development of new penetrating vehicles and solvents. Our experiments demonstrate that these new vehicles and solvents are capable of carrying a great variety of substances into and through grossly intact living tissues at a greater rate of speed than heretofore possible; and also of achieving significant penetration by some substances which could hitherto not be made to penetrate intact human skin to a demonstrable degree.

These experiments, carried on during several years, consisted at first in studying the rate of penetration of certain substances (*e.g.*, sulfonamides, bismuth, mercury, iron) into "colloid models." For these models we used gelatine (simulating the natural protein-gels) and fats, such as wool fat, petroleum jelly and aquaphore (Duke) (simulating the natural lipids).

Specific reagents were added to the models to serve as "indicators"; their characteristic color-changes demonstrated the rate of penetration, the distribution and the chemical reactivity of the various substances embodied in the vehicles under investigation. For example, dimethylaminobenzaldehyde was incorporated in the gelatine models to indicate the penetration, if any, of sulfonamides; potassium iodide or ammonium sulfide to demonstrate penetration of metals such as bismuth or mercury.

A long series of these model experiments revealed that, of all the vehicles and solvents tested, the most massive as well as the speediest penetration was achieved with a combination of: (1) propylene glycol, (2) antipyrine, (3) certain sulfonated wetting agents and (4) xylene or mesitylene. Vehicles composed of such combinations of ingredients were regularly observed not only to effect the most rapid penetration of the incorporated substance, but also to preserve its chemical reactivity, as manifested by the behavior in both the fat and the protein factors of the models.

It was found that the substitution of even closely related chemicals—such as toluene for the xylene or mesitylene—produced a vehicle which did not promote any visible penetration into or reactivity in the fatty medium. Moreover, the presence of certain wetting agents was found to be indispensable to achieve the desired effects in both the fatty and the protein media.

Under the conditions of our experiments, the following wetting agents were found to be useful: (1) Dihexylester of sodium sulfosuccinic acid (Aerosol MA) and (2) dibutylester of sodium sulfosuccinic acid (Aerosol 1 B). The vehicles were also very efficient when parasodium xylene sulfonate was used in place of the combination of xylene and the sulfonated wetting agents just mentioned.

The role of the antipyrine in our combination was not only that of a surface-active agent, but also of an exceptionally good means of increasing solvent action. For example, the hitherto poorly soluble sulfonamides (bases) can be brought into solution in almost any desired concentration through the action of the antipyrine. Moreover, the antipyrine is an indispensable ingredient because of its capacity of transforming the heterogeneous phases into one homogeneous solution. In our early *in vitro* experiments, we had observed that, in the presence of aerosols in the amount used, it was impossible to make a homogeneous solution of propylene glycol and the required quantity of xylene; this difficulty was overcome by the addition of antipyrine. Furthermore, we succeeded in making xylene water-soluble by adding one of the above-mentioned aerosols plus antipyrine.

Three principal combinations, subject to modification, were eventually selected as optimal for studies in penetration through human and animal skin. For the sake of brevity, we have coined the generic term of "Penetrasol" to designate these new vehicles and solvents.

Penetrasol A. Aerosol MA one part by weight, *e.g.*, 20 grams
Xylene one part by volume, *e.g.*, 20 cc
These two components are warmed under reflux. A glassy gel results. This gel is taken up with
Antipyrine one part by weight, *e.g.*, 20 grams
in Propylene glycol, four parts by volume, *e.g.*, 80 cc

Penetrasol B. Same as Penetrasol A, except for the substitution of Aerosol 1 B for Aerosol MA.
(Mesitylene can be substituted for Xylene in Vehicles A and B)

Penetrasol C. Sodium paraxylene sulfonate, one part by weight, *e.g.*, 20 grams
Antipyrine, one part by weight, *e.g.*, 20 grams
in Propylene glycol, 5 parts by volume, *e.g.*, 100 cc

The above described Penetrasols have been employed by us in certain fairly extensive experiments on penetration of living human and animal skins. The results were roughly such as to be expected from our *in vitro* studies.

Thus, the use of Penetrasols with the usual "protein allergens," applied to grossly intact human skin, produced wheals in specifically hypersensitive human subjects. Gentle rubbing for 30 seconds on the unbroken,

[1] The reported experiments were aided by grants from the Dr. Simon Baruch Foundation and from the Wallace Laboratories of New Brunswick, N. J.

normal skin site with a drop of the appropriate Penetrasols to which the powdered specific allergen had been added, produced whealing in over 99.5 per cent. of the tests with those allergens which regularly elicited wheal reactions when applied to the same patient by the ordinary scratch-test method. Every allergen was tested with Penetrasol A, B and C in every individual examination. In most instances, all three vehicles were found to be effective. An interesting finding was that Penetrasols A and B (more lipid-soluble) were superior in carrying pollen, silk, kapok and foods through the human skin; while the more hydrophile Penetrasol C was more effective in dealing with horny materials (*e.g.*, danders), as well as with house dust, cotton and woods.

The penetration of metallic salts and of sulfonamides into and through grossly intact human and animal skin was demonstrated by means of histologic studies and histochemical "indicators." In some instances, new methods were developed to facilitate demonstration of the route and the extent of the penetration. For example, a newly developed histochemical demonstration of sulfonamides employing a solution of 1 per cent. p.-dimethylaminobenzaldehyde in absolute ethylalcohol containing 5 per cent. concentrated hydrochloric acid, will be described in a subsequent, more detailed report.

To date, our histochemical studies have demonstrated the penetration of the intact human skin by: (1) iron (ferric chloride, and ferric ammon. citrate); (2) bismuth (Sobisminol); (3) sulfanilamide. Neither equally concentrated solutions in propylene glycol nor aqueous solutions nor dispersions in lanolin produced such demonstrable penetration into or through intact human or animal skin.

Still another method for demonstrating the penetration was employed in studying the absorption of various sulfonamides (sulfanilamide, sulfathiazole). Inunctions of areas of intact skin of 11 human volunteers were carried out with not more than 1 gram of the sulfonamide in a vehicle of type of Penetrasol A, and repeated in about two hours. Penetration was proved to have taken place by demonstration of the free drug, in the blood and urine. In general, the drugs were demonstrated by a modification of Werner's method. The maxima were reached within one half to three hours after the applications.

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ON HUMAN ANTI-RH SERA AND THEIR IMPORTANCE IN RACIAL STUDIES[1]

SOON after the importance of the Rh factor in erythroblastosis fetalis and in transfusion accidents was established,[2, 3] it was observed that various human anti-Rh sera do not exhibit identical specificities.[3–7] Until recently the three main varieties were identified by their characteristic percentages of positive reactions obtained in the white race, *i.e.*, 87 per cent., 85 per cent. and 73 per cent., respectively.[3–8] In agreement with Landsteiner and Wiener these antibodies may now be termed anti-$Rh_{1.2}$, anti-Rh_1 and anti-Rh_2, respectively. This terminology is based on the observation of Levine[8] that the anti-Rh serum which gives 87 per cent. reactions, in contrast to the others, contains more than one antibody. The anti-Rh_1 serum may be considered as standard since it has a specificity practically identical with that of the experimental serum of Landsteiner and Wiener.‡

From the point of view of diagnosis of erythroblastosis fetalis and the prevention of intra-group transfusion accidents, either one of the two varieties

TABLE 1

TESTS WITH ANTI-RH_1 SERUM

Race	Number tested	Percentages +	Percentages −
White[a]	334	85	15
Colored[b]	264	95.5	4.5
Colored[c]	113	92	8
American Indians[d]	120	92.2	0.8
Chinese[e]	150	99.3	0.7

[a] Levine, Burnham, Katzin and Vogel.[3]
[b] Levine in this study.
[c] Landsteiner and Wiener.[6]
[d] Landsteiner, Wiener and Matson.[9]
[e] Levine and Wong.[10]

[1] Aided by grants from the Blood Transfusion Association in New York City and the National Committee on Maternal Health.

[2] P. Levine, E. M. Katzin and L. Burnham, *Jour. Am. Med. Asn.*, 116: 825, 1941.

[3] P. Levine, L. Burnham, E. M. Katzin and P. Vogel, *Am. Jour. Obst. and Gyn.*, 42: 925, 1941.

[4] A. S. Wiener, *Arch. Path.*, 32: 227, 1941.

[5] P. Levine, E. M. Katzin, P. Vogel and L. Burnham, Chapter XXXI in "Blood Substitutes and Blood Transfusions." C. C Thomas, Springfield, Ill.

[6] K. Landsteiner and A. S. Wiener, *Jour. Exp. Med.*, 74: 309, 1941.

[7] I. Davidsohn and B. Toharsky, *Am. Jour. Clin. Path.*, 12: 434, 1942.

[8] P. Levine, *New York State Jour. of Med.*, 42: 1928, 1942.

[9] K. Landsteiner, A. S. Wiener and G. A. Matson, *Jour. Exp. Med.*, 76: 73, 1942.

[10] P. Levine and H. Wong, *Am. J. Obst. and Gyn.* In press.

‡ Anti-Rh_2 sera were observed independently first by Wiener (*Arch. Path.*, 32: 227, 1941) and shortly thereafter by Levine.[3]

anti-$Rh_{1.2}$ or anti-Rh_1 is preferable to the anti-Rh_2 serum. The practical and theoretical significance of anti-Rh tests in racial studies is evident from the results shown in tables 1 and 2. These are based on tests with anti-Rh_1 and anti-Rh_2 sera.

TABLE 2

TESTS WITH ANTI-RH_2 SERUM*

Race	Number tested	Percentages +	Percentages −
White[a]	334	73	27
Colored[b]	118	46	54
American Indians[d]	69	58	42
Chinese[e]	150	93	7

* The key to authors of these studies is identical with that given under Table 1.

Since the occurrence of erythroblastosis fetalis depends upon isoimmunization of the Rh- mother, the results in Table 1 indicate that a lower incidence of this condition can be expected in the colored, and that it should be extremely rare in the Chinese and the American Indians. In post-mortem studies of fetal and neonatal conditions, Potter[11] found that the incidence of erythroblastosis fetalis was 2.1 per cent. and 0.7 per cent. for the white and colored, respectively. These observations of Potter are confirmed in our recent study of a vast clinical material and by the results indicated in Table 1. So far as the Chinese are concerned, strong confirmation of the correlation of negative reactions with the anti-Rh_1 serum and the incidence of erythroblastosis fetalis will be presented elsewhere. However, it may be stated here that, as was to be expected on the basis of these results, erythroblastosis fetalis is actually exceedingly rare among Chinese infants. A similar low incidence should occur among American Indians, but clinical evidence to support this view is still to be provided.

Obviously, the observations recorded on the racial differences of the Rh reactions with the anti-Rh_2 serum are of considerable interest from an anthropological view-point. However, there is at present no proof of a relationship of these differences to clinical conditions in the new-born of various races.

The relationship of the anti-Rh_2 serum with another variety, termed anti-Hr, produced by an Rh+ mother of an erythroblastotic infant will be discussed elsewhere.

The author is indebted to Dr. E. M. Katzin for supplying blood specimens of white and colored individuals.

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[11] E. Potter, *Jour. Am. Med. Asn.*, 115: 996, 1940.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A METHOD FOR THE IDENTIFICATION OF INDIVIDUAL FROGS

THE various books and articles that deal with the technique of animal experimentation give no satisfactory method for the identification of individual frogs. Some authors state that each frog under observation must be kept in a separate container, or at best suggest that various toes be amputated as a means of subsequent recognition. For several years our work has necessitated the examination of large numbers of frogs over a period of several months. An individual record of each animal was essential, but for practical purposes it was often desirable to keep 10 to 15 frogs in a single tank. This was achieved by making a sketch of the markings seen on the back of each animal. These pigment spots are sharply demarcated in the common laboratory frog, *Rana pipiens*, and are never identical in any two of these animals.

The markings on one of the frogs used in our experiments are shown in Fig. 1. A fold of skin extends from the posterior margin of each eye to the iliac crests at "X." The latter are very prominent and give the animal its normal humped appearance when at rest. Between these folds of skin there are characteristically two rows of pigment spots subject to considerable variation. It is with these markings that we are particularly concerned. The simplified diagram of the spots as used in our records is shown

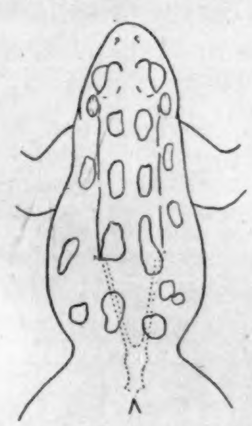

FIG. 1

in Fig. 2 A, where the posterior margin of each eye is indicated by the arc of a circle and each iliac crest by an "X." Figs. 2 B and 2 C portray two variations and the manner of recording them.

We have kept some of these animals for periods of nine to ten months at temperatures ranging from just

above freezing to 90° F and never noted any significant change in the pattern of the markings. At low temperatures the color of the animal as a whole is quite dark, but the pigment spots are still clearly outlined. We have used this method of identification for three years in several hundred frogs and have found it to be consistently satisfactory.

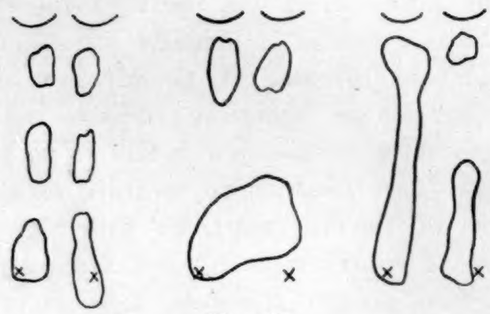

FIG. 2

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MONOTHIOGLYCOL

MONOTHIOGLYCOL,[1] CH_2OHCH_2SH (also designated thioglycol, monothioethylene glycol and β- or 2-mercaptoethanol), is a useful non-nitrogenous sulfhydryl reagent for protein investigations. It is a colorless liquid (b.p. 69–70° (28 mm)),[2] completely soluble in water and most organic solvents. Smythe[3] showed that monothioglycol resembled cysteine and glutathione in its reaction with iodoacetate and iodoacetamide, although the reaction time for monothioglycol was slower. Fischer[2] measured the normal oxidation potential and found it approximately equal to that of cysteine (0.44 volt).

The sulfhydryl content of monothioglycol solutions can be determined readily by iodine titration. As with other SH compounds, dilute solutions in acid are more stable than those in the neutral or alkaline pH range (Table I). Monothioglycol can be added to buffer solutions without appreciably changing pH or ionic strength (Table II). It gives a deep red nitroprusside test. The disulfide oxidation product, in contrast to cystine, is soluble in water in all proportions.

TABLE I

PERCENTAGE LOSS OF SH FROM 0.1 M MONOTHIOGLYCOL SOLUTIONS IN BUFFER SOLUTIONS[a]

Days	Citrate (0.1 M) pH 3.92	Phosphate (0.067 M) pH 6.74	Phosphate (0.067 M) pH 7.89
1	0.4	3.3	4.6
2	1.5	5.6	7.3
3	2.1	7.7	10.6
5	3.1	13.0	18.7
14	9.0	46.0	51.0

[a] In half-filled glass-stoppered clear glass bottles, diffuse light, 25–30°.

TABLE II

CONDUCTANCE OF MONOTHIOGLYCOL

Solute	Solvent	Specific Conductance[a] reciprocal ohms
0.1 M Monothioglycol	0.001 M Acetate buffer (pH 6.5)	5.2×10^{-5}
0.1 M Thioglycolic Acid	0.001 M Acetate buffer (pH 6.5)	3.4×10^{-3}
None	0.001 M Acetate buffer (pH 6.5)	4.4×10^{-5}
0.125 M Monothioglycol	0.1 M Acetate buffer (pH 6.5)	3.4×10^{-3}
None	0.1 M Acetate buffer (pH 6.5)	3.5×10^{-3}
0.125 M Monothioglycol	0.1 M Glycine–NaOH buffer (pH 11.8)	3.6×10^{-3}
None	0.1 M Glycine–NaOH buffer (pH 11.8)	3.8×10^{-3}

[a] Measured at 0.8° C. with freshly prepared solutions.

That monothioglycol is a reducing agent for the disulfide linkages in proteins is indicated by its effect in increasing the solubility of keratins, decreasing the viscosity of enzyme-free wheat gluten dispersions and activating papain. It should be found useful in providing a suitable environment for preventing the air oxidation of reduced proteins during dialysis without interfering with subsequent mobility determinations. Details of the experiments mentioned will be described in later publications.

Dr. C. B. Jones studied the keratin solubilities and Dr. Hans Lineweaver performed the papain assays.

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[1] The Carbide and Carbon Chemicals Corporation kindly furnished a generous sample.

[2] E. K. Fischer, *Jour. Biol. Chem.*, 89: 753, 1930.

[3] C. V. Smythe, *Jour. Biol. Chem.*, 114: 601, 1936.

BOOKS RECEIVED

FISHER, EDNA M. *The Osteology and Myology of the California River Otter.* Illustrated. Pp. vi + 66. Stanford University Press. $1.50.

FLEXNER, WILLIAM W. and GORDON L. WALKER. *Military and Naval Maps and Grids.* Illustrated. Pp. 96. The Dryden Press, New York City. $1.00.

O'NEALE, LILA M. *Textile Periods in Ancient Peru: II. Paracas Caverns and the Grand Necropolis.* Illustrated. 5 Plates. Pp. vi + 201. University of California Press.

Ore Deposits as Related to Structural Features. Edited by W. H. NEWHOUSE. Illustrated. Pp. xi + 280. Princeton University Press; Oxford University Press, London. $6.50.

Pirotechnia of Vannoccio Biringuccio. Translated by CYRIL STANLEY SMITH and MARTHA TEACH GNUDI. Illustrated. Pp. xxvi + 476. The American Institute of Mining and Metallurgical Engineers, New York City.

SPOTT, ROBERT and A. L. KROEBER. *Yurok Narratives.* Vol. 35, No. 9. Pp. 143–256 + vii. University of California Press.

TANNER, JAMES T. *The Ivory-Billed Woodpecker.* Illustrated. Pp. xii + 111. National Audubon Society, New York City. $2.50.